

## Hybrid Dual-Fuel Industrial Heating Systems



Dual-fuel heating systems, combining the benefits of electric and gas technology, will be able to capitalize on the expected variability of spot prices for electricity and natural gas and apply to a wide variety of parts and processes.

This multi-phase program's ultimate objective will be the development and commercialization of a hybrid electric and gas-fired heating system. The program will include a comprehensive techno-economic study and several development phases with appropriate go/no go decision milestones.

**PROJECT DESCRIPTION** The concept of using both electricity and gas as the energy source for industrial process heating is not new. During the "energy crisis" of the 1970s, several designs were proposed, primarily in response to the gas industry's practice of shutting off gas to industrial customers for diversion to residential accounts during cold winter months. Without an appropriate back-up energy source, critical industrial processes were forced to scale-back operations or completely shut down. The natural gas shortage, however, was resolved before many of these systems could be purchased and installed. Again in the mid-1980s, a study was conducted to investigate the feasibility of dual-fuel heating systems. The study, which considered indirect electric resistance heating combined with gas convection, indicated that under certain conditions

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the additional cost of a secondary energy source could be justified in 3-5 years by avoiding unscheduled shut-downs. These systems could permit the user to easily switch between two different energy sources without impacting the process, or alternatively, utilizing the energy source that is most appropriate for a given phase of the process.

As we enter the new millennium, a new variable, retail energy competition, could significantly impact this technology. With competition, energy prices may change on an hourly, daily, and seasonal basis for both gas and electricity. Today, an industrial manufacturer considering the purchase of new process heating equipment must forecast the price of electricity and gas for the next 15-25 years (the expected lifetime of the equipment) in order to calculate and minimize operating costs. With the anticipated volatility of energy prices, manufacturers will be uneasy about making such long-term commitments to a single energy source and will be looking for equipment that permits selection of the least expensive fuel on a more timely basis.

Having a secondary energy source also eliminates the need for back-up or stand-by energy sources, such as propane, which can be problematic or prohibited by local regulations.

In addition to the new operating environment for these heating systems, other developments have improved the commercial viability of dual-fuel systems. New materials have been developed for gas heating systems (metal and ceramic radiant tubes) and more efficient electric heating

methods (resistance, infrared and induction) have been proven commercially successful. The right time is now to reintroduce this technology and develop commercial products.

**PROJECT SUMMARY** The first step of this project will be a study to examine the technical merits of such a program and the requisite economic circumstances that will make it successful. This study would need to answer the following questions from a technical perspective:

1. What is the current state of the technology—what could be accomplished without major new technical developments?
2. What are the operational limitations to these heating techniques?
3. What recent developments in materials and/or heating systems that, if developed, could lead to an improved dual-fuel heating system.
4. How will these technical developments positively impact the operation of a hybrid heating system?

This study must also address economic justification:

1. What industries and/or processes would be most severely impacted by gas curtailment or wide energy price swings?
2. What volatility can be expected in short-term energy prices—gas and electric?
3. What capital cost premium will this energy price variation justify?

Development and commercialization of the technology will be accomplished through a strategic partnership with key technology providers and/or equipment manufacturers.

**DELIVERABLES** The deliverables will vary by phase, but will include technical reports, economic analysis, development hardware and commercial equipment.

**BENEFITS OF PARTICIPATION** This project provides a unique opportunity to establish a proprietary position on a new technology and related process heating equipment. If successful, project sponsors would receive returns based on units sold, and could be in a position to offer a proprietary product to their industrial customers. An additional benefit is added electrical load since this technology would probably replace some gas process heating with electricity.


Each year some 500-1000 furnaces and ovens are sold in the US. While it is unknown at this time what percentage of this market would represent potential candidates for dual-fuel heating technology, even a small percentage could represent a sizable business. A more representative potential market size could be the number of radiant tube gas burners sold annually, which is about 40,000 units per year (based on 217,000 units in services with an average 5-year life).

**PRICE OF PARTICIPATION** The total cost of this program is in the range of \$300,000-\$500,000 over a period of several years. The initial study phase of the program can be completed for \$75,000. The costs for subsequent phases will be established at the conclusion of each phase and participants will have the opportunity to choose continuation in the program. Program costs will be shared equally by the participants.

**PROJECT STATUS AND SCHEDULE** This project is currently identifying interested funders and other participants. The Gas Research Institute has indicated interest in the program. Early funders will receive prorated portion of the commercial revenues and the potential of obtaining exclusive property rights.

**CONTACT INFORMATION** For more information on this unique product development opportunity, contact EPRI Center for Materials Fabrication at [epri-cmf@infinet.com](mailto:epri-cmf@infinet.com), Gary Walzer (614-421-3440, Fax 614-421-3446), or Jim Wade (440-563-3823).

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